COURSE OBJECTIVES AND OUTCOMES:
Students learn the process of scientific research by investigating an open-ended research challenge posed by local laboratories from the Texas Medical Center & Rice University. Teams of students work in developing and characterizing diverse research methods to address the challenge.

Course objectives: Students should learn:

1. How to address an open-ended research challenge,
2. To work collaboratively on a team to apply the scientific method while solving the challenge,
3. To communicate the critical steps in the research process in written and oral formats.

Course outcomes/skills: At the end of the class students will have gained skills relevant to their future laboratory work in teaching and research labs. Students completing this course should be able to:

1. Understand a research question, both the 'big picture' and specific challenge,
2. How to define a goal for a research project;
3. How to determine if/when the goal is achieved;
4. Conduct background research in the existing literature to understand a research challenge and identify published work relevant to the question at hand;
5. State a clear hypothesis they can test;
6. Design an experiment, effectively incorporating both positive and negative controls, and articulate how the experiment will prove or disprove the hypothesis;
7. Conduct the experiment, keeping a detailed notebook, **a**. describing their experimental design, **b.** recording all research activities, **c.** collecting the obtained data and **d.** communicating a clear conclusion for each experiment;
8. Learn basic laboratory skills relevant to their project area;
9. Interpret the data collected and articulate conclusions supported by their observations;
10. Understand how negative results can advance their research goals and appropriately re-design their experimental methods;
11. Communicate their research findings in written and oral formats.

Meeting Time and Location:
Section 001: T/TH 9:25 AM -10:40 AM, Location ABL 129
Section 002: T/TH 10:50 AM -12:00 PM, Location ABL 129
Section 003: T/Th 8:00 AM – 9:15 AM, Location ABL 129

All students must be prepared to work at least 5 hrs per week on their projects outside of assigned class time. This is not optional.

Course instructors:

Name	Email	Office hours	Location
Dr. Carrie McNeil	cvmcneil@rice.edu	Thursday lunch at Brown Th 1:00 PM – 2:00 PM	Office- DBH 241
Dr. Melissa McGovern (Section 001)	Melissa.McGovern@bcm.edu	F 9:00 – 11:00 AM	ABL 129
Dr. Yocheved Schindler (Section 002)	Yocheved.Schindler@bcm.edu	M 9:00 – 11:00 AM	ABL 129
Dr. Neal Rasmussen (Section 003)	nrasmussen@ibt.tamhsc.edu	W 10:00 AM – 12PM	ABL 129

TAs: Teaching assistants for your project will be assigned during Week 3 and their contact information will be listed on Canvas.

Method of Instruction:

Class will be based on short lectures addressing the steps of the scientific method and topics like searching the literature, defining a hypothesis, and the ethics of research, short -in class exercises and lab work conducted in class. Students will work with their teams during class, as well as having access to the lab on Monday and Wednesday mornings by appointment. TAs will always be able to work with students during normally scheduled lab time and during scheduled lab office hours. If a student wants to work in the lab outside the normal lab time, there must be a mentor, TA, or instructor supervising the lab, and the student must arrange for one of them to accompany them in advance. Project mentors/clients will be available by appointment to meet with teams.

Team Formation and Expectations:

Active, productive engagement is expected of all students. Teams will be formed based on student schedule, interest and project availability. Students will work in their research team throughout the entire semester. Students will have research team meetings during most class periods. For this reason, attendance in class is required of all students except for illness or family emergency. *Research teams are also expected to meet outside of class. Expect to spend approximately 5 hrs per week in the lab working on your research project.*

Each member of the team is expected to contribute equally to the project. While the types of contributions will vary, the effort should be comparable. It is also important that regular team responsibilities rotate. For example, one person should not act as the recorder for every meeting; rather, everyone on the team should take turns with this job.

Peer evaluation of student design teams will be conducted using the online CATME system. Instructor input will be valued as well, using the process described below.

Overall Point Distribution:

Activity	Points	Percentage
Peer evaluation (CATME)	100	10%
Lab practicum	95	9.5%
Lab notebook	150	15%
Scientific writing	305	28%
Presentations	225	25%
Instructor evaluation	125	13%
Overall	1000	100%

CATME Score: You and your teammates will periodically evaluate one another using the CATME Team Tools Survey. Your personal grade will be 25 for completing the survey. **If you do not complete the survey, you will receive a zero (0) for that portion of your grade, no exceptions.**

Notebook reviews: Each ***team*** is expected to keep a laboratory notebook throughout the semester, in accordance to the guidelines that are outlined in the Rubrics section of Canvas. You will be assigned a notebook for each team, to track their work for the semester. For each experiment, a clear description of the **goal** of the experiment, **experimental** plan, **results** and **conclusions** will be clearly written (it is important that others can read your work- so neatness counts!). Notebooks will be collected and graded two times during the semester.

Scientific communication: The goal of this course is to teach you the scientific process, so we will have periodic deadlines of work products (written and oral) that go over the steps of the scientific process. The general goal of these assignments is that you should easily be able to assemble your final paper based by consolidating the individual parts.

1. Hypothesis statement: A testable statement of what you think will occur during your research this semester. It should also be <200 words and include at least one "Aim", which is the experiment that you will use to test the hypothesis.
2. Oral presentation of the problem and hypothesis to class: *Your team will present your overall problem and hypothesis to the class.* Please limit your presentation to 4 slides.
3. Background literature: Each member of your team will collect a different peer reviewed paper regarding the problem that you are solving, not including the ones provided by your mentor. A 1 page summary of the literature should be presented, along with how the paper is related to the problem being addressed this semester. Be sure to properly cite the paper in the Bibliography. I will go over how to use a free scientific citation manager (Mendeley) in class. This assignment will be graded for your individual effort.
4. Methods and Materials: The experimental methods that have been conducted to date should be presented, along with necessary citations. This should follow the same format as that used in scientific literature. Use prose form and not a list of steps. Be sure to include enough detail that someone could reproduce your work, including the sources of all your materials.
5. Results and discussion section: You should report at least three results that you feel very confident in, including a proper graph of the data for each result, written analysis and discussion of the result. Be sure to include relevant statistics and error bars. Site any appropriate references.

Written reports are due into Canvas by the deadline listed in the Assignment Matrix (page 5). Late assignments will have a 50% maximum grade and will only be accepted one week after the assigned due date. Most writing assignments (excluding the problem statement and background literature) will be team assignments, so give yourself plenty of time to coordinate with your teammates prior to the deadline.

All written assignments should be 1.5 spaced-spaced in 12-point Times New Roman font with 1-inch margins on each side. Your team name, the date, and the course/section should appear on the header of each page. References must be clearly cited in all written assignments. American Medical Association citation style should be used for all papers. Information on this citation format can be found here:http://medlib.bu.edu/facts/faq2.cfm/content/citationsama.cfm. The free reference manager, Mendeley (http://mendeley.com/), can be helpful in creating your bibliographies.

Final Written Reports: You will deliver a written report that summarizes your results. The paper should include the following parts: **Abstract** (concise description of your results in <500 words), **Introduction / Background**, **Methods and Materials**, **Results**, **Conclusion**, **References cited**, and **Acknowledgements.** You will receive feedback from the instructor within one week of submission. If you choose, you may revise your report based on this feedback, but the revision must be submitted

prior to the final exam date assigned by the registrar. The reports should be a team product and be approximately 10 pages in length.

Communicating Results: Teams will present three times to the class. The presentations will be no more than 12 minutes long and allow 3 minutes for questions from the audience. ***All team members must participate in all presentations***.

Poster presentation: Each team will present their results from this semester at a poster session at the end of the semester. Each team member must be present. You will be given a Powerpoint template that includes instructions on how to create a poster.

Instructor evaluation: Following all safety rules for a laboratory is critically important, especially when working with chemicals and hazardous materials. There will be a safety quiz on the second day of class that will test whether you understand the basic safety rules. Wear proper attire (long pants, closed toe shoes, safety gloves) and safety glasses at all times. A lab coat is recommended especially when working with various chemicals. At the end of the semester, your mentor will assign you a grade for your work that includes a feedback to Dr. Bishnoi about how well you followed safety guidelines, laboratory technique, attendance, and distribution of work. **During the semester, if you are caught breaking any of the safety rules, then points will be deducted from a total possible points of 125. Please watch the safety video at https://www.youtube.com/watch?v=rMq3ABIITVc&feature=youtu.be prior to Lab 2.**

Honor System Policy: As with all endeavors at Rice, you are expected to adhere to the Honor Code and follow the guidelines given in the Blue Book. Exams are given under the honor system. Students are encouraged to work together collaboratively on the projects, but each student is expected to contribute an equal share to the final project. Plagiarism includes copying or using a resource without proper citation (to include appropriating the ideas of another person without accrediting the source). American Medical Association citation style should be used for all assignments where citations are needed. Information on this citation format can be found here:
http://medlib.bu.edu/facts/faq2.cfm/content/citationsama.cfm

Students are encouraged to bring any concerns involving academic integrity to the attention of the instructor. More information can be found at www.ruf.rice.edu/~honor**.** If at any point, you are unclear about the honor system and how it works, please contact me.

Disabilities: If you have a documented disability that requires accommodation, please let me know so that we can confidentially discuss your needs. You will also need to register with the Disability Support Services Office in the Ley Student Center.

Canvas: All course readings will be uploaded onto Canvas. I will use this as a primary means of interfacing with the class outside of course times. Make sure to check this site frequently for course updates or additional course materials. This is our first semester using Canvas, so please forgive any technological difficulties that arrive in the course of our transition from Blackboard.

Expectations about E-mail and Laptop Use in Class: A laptop or a hand-held device may be used during class to look up information regarding your project or process data. You should not be surfing the internet, reading e-mail, or sending text messages during the class period. I welcome e-mailed questions and concerns about your work and the course in general. Please ensure that your e-mailed notes include a salutation, closing statement and your full name. E-mailed notes should be written in a professional manner.

***This syllabus is a plan for the course, and is subject to change at the discretion of the instructor. Any changes will be announced. ***

Class activities and assignments	**Max Points**	**Date due**	**Time due**	**Location**	**Type of Assignment**
Module 1: Safety training video quiz	20	8/24/2018	class	Canvas	individual
Module 2: Pipetting pointillism	20	8/24/2018	10:00 PM	Canvas	individual
CATME: Initial team maker survey	25	8/27/2018	10:00 PM	CATME	individual
Module 3: Quantitative Pipetting	25	8/31/2018	10:00 PM	Canvas	individual
Module 4: Section specific	30	9/10/2018	10:00 PM	Canvas	individual
Background literature	40	9/12/2018	10:00 PM	Canvas	individual
Hypothesis statement	40	9/17/2018	10:00 PM	Canvas	group
Presentation of Problem and Hypothesis	**50**	**9/27/2018**	**class**	**ABL 129**	group
CATME evaluation I	25	9/26/2018	10:00 PM	CATME	individual
Notebook review 1	50	10/12/2018	class	instructor	group
Team Update Presentation	**50**	**10/18/2018**	**class**	**ABL 129**	group
CATME evaluation II	25	10/20/2018	10:00 PM	CATME	individual
Materials and Methods section	50	11/5/2018	10:00 PM	Canvas	group
Results and discussion section	50	11/19/2018	10:00 PM	Canvas	group
Poster Powerpoint draft	50	**11/27/2018**	10:00 PM	Canvas	group
Final Notebook	100	11/30/2018	class	instructor	group
Final poster presentation	**100**	**11/30/2018**	**class**	**TBD**	group
CATME evaluation III	25	12/1/2018	10:00 PM	CATME	individual
Final paper	100	12/3/2018	10:00 PM	Canvas	group
Overall mentor grade	125	12/10/2018	NA	instructor	individual
	1000				